Preferences of people with a chronic disease towards physical activity e-coaching: a discrete choice experiment

MASTER THESIS
M-HS

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Preface

This thesis is the completion of my master's degree in Health Sciences at the University of Twente, specializing in Innovation in Public Health. Over a period of 8 months, I worked on this final report of my master's thesis. I was excited to explore a topic that has always interested me. I would like to express my deepest gratitude to my supervisors who helped me write this thesis. Firstly, dr. A. Middelweerd and E.A.G. Hietbrink I would like to thank you for your feedback and involvement in my project. You gave me the new ideas and inspiration that I needed. Secondly, I would like to thank Dr. J.A. van Til for joining my thesis as an expert. Lastly, I would like to thank R.M.E. Vaseur for her knowledge and support during the last month of my thesis. Finally, I would like to thank all the participants who made the effort to participate in my research by filling out the questionnaire.
Happy reading!

October 2022,
Aniek Leusink

Abstract

Background: More than 30% of the Dutch adults suffered from one or more chronic disease(s) in 2020 (Volksgezondheid en Zorg, 2021). In recent years, there has been increasing evidence of the positive effect that a healthy lifestyle can have in treating people with lifestyle-related chronic diseases. Mainly physical activity is an important lifestyle behavior in the management of several chronic diseases. Any additional amount of physical activity is advantageous and can help reduce pain and stress, as well as depressive symptoms and the risk of secondary health conditions, such as reduced fitness (Krops, 2017; WHO, 2018; NNGB, n.d.). Despite the benefits of physical activity on chronic disease prevention and management, people find it difficult to commit to it (Klein et al., 2013).

The E-Manager program aims to promote healthy lifestyles while improving patient-centered health care. The E-Manager project is concerned with developing a coaching platform (the E-supporter) to help people with chronic disease improve their lifestyle by providing personalized coaching. Through motivational messages and exercises, the E-supporter provides personalized coaching aimed at maintaining a healthy lifestyle and helping people learn to cope with barriers (Hietbrink, 2020). This study aims to identify preferences for physical activity coaching through the E-supporter app. Furthermore, this study identifies whether clusters can be sorted based on people with the same levels of health and whether they share the same person characteristics and preferences for an exercise program.

Aim: To investigate individual preferences towards physical activity coaching in adults with one or more chronic condition(s), to identify clusters of individuals with the same levels of health, and to identify whether individuals in these clusters differ by their demographics, health characteristics and preferences for an exercise program (Pinto et al., 2019).

Methods: By means of multinomial logit analysis a Discrete Choice Experiment was performed, to determine the preference weights for the attribute levels and to identify the relative importance of the 6 attributes. In addition, two cluster were designed to identify groups with similarities based on their level of health. To determine whether there is a significant relationship between the individuals in these clusters and their demographic and health characteristics, a chi-square test was conducted. Lastly, a multinomial logit analysis was conducted to determine the similarity and differences between the clusters regarding their exercise program preferences.

Results: The attribute with the highest importance, compared to the other attributes, was health improvement. Intensity was seen as the second most important attribute, with the respondents having a higher preference for exercising 3 times a week for 30-45 minutes at a time instead of exercising 5 times a week for 20-30 minutes. Furthermore, the respondents indicated that

they preferred to receive guidance both face-to-face with a supervisor and guidance through the app. In addition, respondents preferred to receive weekly messages, rather than daily. The attribute with the lowest relative importance compared to the other attributes was type of guidance. Respondents attached the least importance to an app that was fully customized to their personal situation. Moreover, respondents indicated that they prefer light-intensity training rather than vigorous-intensity training.

The results of the cluster analysis showed that a significant effect existed only between gender and the clusters. No significant relationship could be shown between the clusters and age, chronic disease or IPAQ category.

The clusters differ from each other in terms of the attributes activity type and intensity. In contrast, the clusters correspond in their preferences for moderate health improvement, a coaching app that is not fully customized, an app that sends weekly messages and provides coaching both through the app and in a coaching practice.

Conclusion: The E-supporter app can increase the willingness to exercise for people with chronic diseases by showing them the improvements that exercising can have on a person's health. Furthermore, it is recommended to offer exercise programs that are lightly or moderately intensive, given the potential limitation a person with a chronic disease may experience. Moreover, the app does not motivate if it sends multiple messages throughout the day, requires many health measurements and when individuals are only guided in a coaching practice.

Keywords: Preferences, physical activity, e-coaching, chronic diseases, Discrete Choice Experiment, stated preferences

Contents

Abbreviation List

Abbreviation	***Description***
App	Application
COPD	Chronic Obstructive Pulmonary Disease
DCE	Discrete Choice Experiment
DM	Diabetes Mellitus
EQ-5D-5L	EuroQol five-dimension 5-levels scale questionnaire
IPAQ	International Physical Activity Questionnaire
ISPOR	International Society for Pharmacoeconomics and Outcomes Research
MET	Metabolic Equivalent of Task
mHealth	Mobile Health
NNGB	Nederlandse Norm Gezond Bewegen
n	Sample Size
QR-code	Quick Response code
RI	Relative Importance
SD	Standard Deviation

1. Introduction

In 2020, 32.2% of Dutch adults over the age of 16 had a chronic disease or other long-term health issue (Volksgezondheid en Zorg, 2021). This number is predicted to rise even more in the upcoming years, in part due to population growth and aging, but also due to the people's unhealthy lifestyle (nivel, 2011). Chronic diseases are particularly prevalent among the older generation, but also at a young age (rivm, n.d.). A chronic disease, or also referred to as "chronic illness", is a disorder that lasts at least one year and requires medical supervision. Examples of chronic diseases include cardiovascular disease, diabetes mellitus (DM), Chronic Obstructive Pulmonary Disease (COPD), and musculoskeletal disorders (rivm, n.d.). People with a chronic disease are often limited to some extent in their daily lives due to reduced physical functioning and limited physical capacity. Furthermore, people with a chronic disease often experience discomfort due to pain, low energy levels, fatigue, and other disease-related symptoms (Hietbrink, 2020; Hannan & Bronas, 2017; Bullard et al., 2019; García-Pérez, 2013). Life expectancy is also estimated to be approximately 7.5 to 20 years shorter, especially in people with multimorbidity (Li et al., 2020).

The results of a systematic review showed that up to 60% of early deaths are caused by individuals with chronic diseases who lead unhealthy lifestyles (e.g., smoking, being inactive, having an unhealthy BMI, etc)(Li et al., 2020; Nyberg et al., 2020). Furthermore, a healthy lifestyle, with adequate exercise and a healthy diet, also reduces the risk of developing chronic diseases such as depression and cardiovascular disease (nivel, 2011). A healthy lifestyle is equally critical for those already suffering from chronic diseases. Mainly physical activity is an important lifestyle behavior in the management of several chronic diseases. Physical activity helps to reduce pain and stress, as well as depressive symptoms and the risk of secondary health conditions, such as reduced fitness, obesity and hypertension (Krops, 2017; WHO, 2018). Hence, physical activity can improve overall quality of life and well-being (Weber et al., 2021; WHO, 2018). These health benefits occur not only through vigorous physical activity. Any additional amount of physical activity is advantageous, regardless of the duration, intensity, frequency, or type of exercise (NNGB, n.d.). Low-intensity physical activity exercises (well below the current public health recommendations) can reduce mortality in older adults by 22% and ensures more functional independence (Arem et al., 2015).

Despite the benefits of adequate physical activity on chronic disease prevention and management, people find it still difficult to truly adhere to the physical activity guidelines (Klein et al., 2013). The Dutch guideline 'Nederlandse Norm Gezond Bewegen' (NNGB) states that adults and elderly should exercise at least 150 minutes of moderately intensive (>=4 METs (Metabolic Equivalent of Task)) per week, distributed over several days

(Gezondheidsraad, n.d.). However, just above 50% of the general adult population without chronic diseases in the Netherlands is sufficiently active according to physical activity recommendations (Loef et al., 2016). This low percentage is partly causal due to the changing patterns of transportation, the increased usage of technology (WHO, 2018) and the corona pandemic (Loketvoorgezondleven.nl, n.d.). Statistics show that people who are disabled or chronically ill are significantly less often physically active in the Netherlands (41%) compared to healthy people (64%) and that whilst many of those with a chronic disease experience only slight discomfort (Krops, 2017). Some reason for not being physically active with a chronic disease may be that they have fewer opportunities and resources to be physically active in safe, affordable, and appropriate programs and places (WHO, 2018). Low physical activity rates among adults with chronic illness may warrant greater concern than those of the general adult population, given their increased risk of developing serious secondary medical problems (e.g., obesity, social isolation) (Cervantes & Taylor, 2011).

To achieve healthy exercise behavior an approach that focuses on disease symptomatology, mobility limitations, and is tailored to the patient, may help to increase physical activity levels (Pedersen & Saltin, 2015; Bullard et al., 2019). In addition, interventions that include self-regulatory skills (e.g., self-monitoring) can result in high-therapy adherence rates (Bullard et al., 2019) Across all settings, where people live, play and work, digital innovations can be applied to motivate and support people with chronic diseases to become more active (WHO, 2018). With the increasing use of mobile devices, Mobile Health (mHealth) is a feasible and promising way of reaching people with a chronic disease to stimulate physical activity. mHealth offers the ability to monitor personal data (e.g., activity levels) to help promote physical activity. Based on these individual measurements, tailored coaching, feedback, and support can be provided. Motivational messaging and feedback are critical to encourage people with chronic diseases to exercise as much as possible (Hannan & Bronas, 2017). Particularly with a new participant, a lot of valuable feedback must be provided to keep the user committed to the system. The application should link medical knowledge to individual patient data and thus provide user-specific reminders, alerts (health risks) and individual guidance (Mattila et al., 2010). By using an application, including an Internet platform and mobile measuring devices, personal coaching can be given, which considers individual person characteristics (Sommer et al., 2020). Particularly for patients who have difficulty accessing health services, coaching by an application offers a solution (Yang et al., 2020). Another promising way to stimulate and engage people is with tailoring. Tailoring is described as "any combination of information or change strategies intended to reach one specific person, based on characteristics that are unique to that person, related to the outcome of interest, and have been derived from an individual assessment" (Davis et al., 2020). Individual factors (e.g., age, gender, perceived barriers, and physical discomfort), sociocultural factors (e.g., friends who practice physical exercises, cultural norms) and

environmental factors (e.g., exercise facilities) must be considered (nhg, 2015; de Rosis et al., 2020). Addressing these individual needs, interests, motivation, and behavioral level may increase adherence to treatment. This involves developing specific and tailored interventions that can be adapted to a variety of settings, intensities, and types of activities (Dintsios et al., 2018).

There is a wide variety of programs to support people with chronic diseases, both online and offline. This variety of interventions all have different strategies, for example, one approach focuses on supervised physical activity (e.g., face-to-face interventions) while others address unsupervised physical activity (e.g., exercise examples through the telephone) (Conn et al., 2011). Whether people will be motivated to exercise and engaged to use a program depends on personal factors and the trade-offs they are willing to make. Some reasons for use that have led to the success or failure of the intervention are that for some people mHealth features (e.g., self-tracking) are seen as an opportunity for empowerment, while others perceive it as an invasion of privacy (Carter et al., 2018). What people do highly value in a physical activity program is that they are compensated with a reward. Every day, people make decisions about the amount of physical activity they are willing to undergo. Thus, people consider whether it is worth walking 10 minutes longer to buy cheaper products or they consider whether it is worth standing in line for 20 minutes to get a refund (Hsu, 2014). Physical activity can as well be compensated with health benefits (e.g., decreased blood pressure, weight loss), but the question is what people are willing to do for this. It is relevant to find out the willingness to participate in a physical activity program influenced by characteristics such as intensity and health gain and to find out what trade-offs between these factors people with chronic diseases make in order to participate or not in an e-health physical activity intervention. Information about preferences is important to guide provision of physical activity interventions for this target group (Paul et al., 2021). There is still insufficient insight into the preferences and perspectives of end users of a physical activity program. This can be of high value to realize improvements in future interventions (Carter et al., 2018).

The main objective of this study is to investigate individual preferences towards physical activity coaching, which can contribute to the development of an e-health app among adults with chronic diseases. The second objective is to identify clusters of individuals with the same levels of health, and to identify whether individuals in these clusters differ by their demographics, health characteristics and preferences for an exercise program (Pinto et al., 2019).

To achieve this goal, the following research questions have been formulated:

- What are the preferences of people over the age of 18 with one or more chronic diseases towards physical activity e-health interventions?
- Are there certain patient groups (clusters), consisting of individuals with similar levels of health, with the same person characteristics and the same preferences for physical activity e-health interventions?

The central hypotheses underlying this thesis are that people with a chronic disease value specific components of physical activity programs (Aboagye et al., 2017). This has to do with personal characteristics (e.g., age, gender, severity of symptoms) as well as personal preferences. It is expected that as the severity and level of discomfort of the chronic disease increases, this will influence preferences for exercise programs. It is also expected that individuals will prefer light to moderate intensity exercise and that high-intensity exercise will be rejected. Furthermore, individuals tend to prefer short (20-30 min) exercise sessions over long exercise sessions (45-60 min). In addition, low frequency (1-2 times per week) is preferred over greater frequency (4-5 times per week). (Geidl et al., 2018; Beaudart et al., 2022). Furthermore, studies suggest that the willingness to participate to an exercise program is increased as individuals receive a reward (e.g., health benefits) for it. When an exercise routine leads to physical or psychological benefits, individuals will be more willing to add additional exercises (Paul et al., 2021; Aboagye et al., 2017; van Gils et al., 2011). To conclude, a physical activity e-health intervention is considered motivating if it is personalized and tailored, fits the right age group, is easy to use, and has a clear end-goal that includes a reward system (Martin et al., 2020). Furthermore, physical activity interventions are argued to be most effective when people receive regular messages and support delivered via telephone. As age increases, there is a greater preference for independent practice with little instruction (Wilcox et al., 1999).

2. Methodology

To answer the research questions, a questionnaire was conducted. This chapter explains how the questionnaire was created, who the study population is, and how they were recruited to take part in the research. This chapter also explains how the statistical analysis was carried out and the ethical considerations that have been considered.

2.1 Study Design

2.1.1 Discrete choice experiment

To elicit preferences a research approach known as "Discrete Choice Experiment" was used. A Discrete Choice Experiment (DCE) is defined by Carson and Louviere as "a general preference elicitation approach that asks agents to make choice(s) between two or more discrete alternatives where at least one attribute of the alternative is systematically varied across respondents in such a way that information related to preference parameters of an indirect utility function can be inferred" (Carson & Louviere., 2011). A DCE is a type of a stated-preference method that studies hypothetical preferences of patients and other stakeholders. This method includes many different techniques, such as conjoint analysis and DCE, which is the most commonly used (Johnson et al., 2013). In a DCE, respondents are asked to choose between hypothetical objects described by a set of attributes (e.g., side effects). Each attribute has a number of levels and by varying these levels in each question, it is possible to analyze trade-offs made by respondents (Webb et al., 2021). In the past, a DCE was only applied to determine appropriate product prices. In recent years, DCE has also been increasingly performed in health care and can be extremely valuable for measuring hypothetical preferences in a broad range of health applications, such as weight loss programs and diabetes prevention (Bridges et al., 2011; Offermann-van Heek & Ziefle, 2019).

The International Society for Pharmacoeconomics and Outcomes Research (ISPOR) has developed an illustration (Figure 1) with the key stages of developing a discrete choice experiment (Johnson et al., 2013).
Based on this illustration, this study was structured.

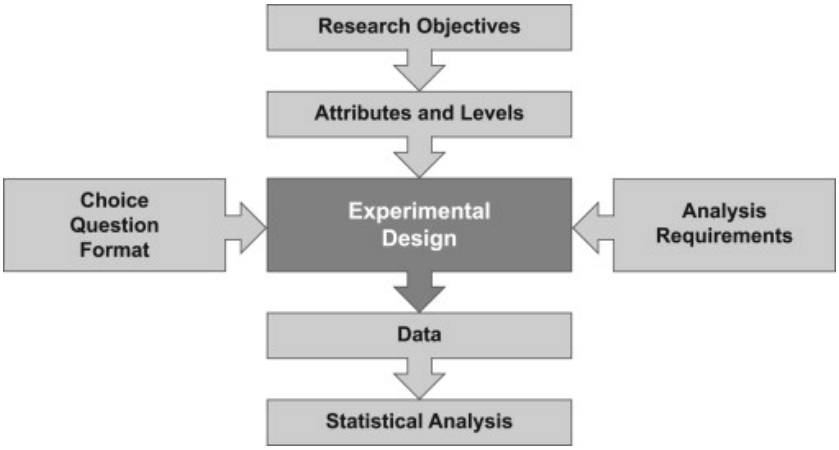

*Figure 1; Key stages for developing a discrete choice experiment

2.1.2 Attributes and levels

Selecting, identifying, and defining the appropriate attributes and attribute levels is the most important step in the preparation and implementation part of a Discrete Choice Experiment (Offermann-van Heek & Ziefle., 2019). The attribute list is designed to contain specific characteristics (attributes) to test what the preferences are of people with a chronic disease in terms of coaching to be physically active. Along with this is the range of values (levels) at which the attributes are tested. Through a literature review (appendix C), guidance from supervisors and an expert, relevant attributes and their levels were selected. Concerning the attribute levels, it was important to keep the number of levels the same among the attributes. According to the literature review, attributes associated with factors which stimulate physical activity are frequency and intensity of exercise, type of exercise and design. In addition, incentives (e.g., health benefits) have a positive influence on health-related behaviors and choices (Aboagye et al., 2017; de Guzman et al., 2015; Geidl et al., 2018; Paul et al., 2021; Pinto et al., 2019; van Gils et al., 2011). Other attributes (e.g., type of guidance, deployment of the app, deployment of personal assistance) and their levels were selected during meetings with the supervisors (E-supporter developers). During the meeting, it was discussed which components of physical exercise are important in the future development of the e-supporter app for physical activity promotion.

A total of 12 potentially relevant attributes were identified. Eventually, this number was consolidated to 6, to reduce the burden on participants, by grouping overlapping domains (e.g. Time per physical activity, frequency of physical activity). To conclude, attributes were removed that were incapable of being traded or not experimentally manipulable (e.g. enjoyment) (Pinto et al., 2019). An overview of all attributes and their levels are shown in Table 1.

*Table 1; Overview attribute list

Attributes	***Number of levels***	***Attribute levels***
Intensity	3	- You exercise once a week for 45 to 60 minutes at a time - You exercise 3 times a week for 30 to 45 minutes at a time - You exercise 5 times a week for 20 to 30 minutes at a time
Activity type	3	- Light intensity: Walking or Swimming - Moderate intensity: Jogging, Cycling or Ball Sports - Vigorous intensity: Running, Aerobics or Cycling
Health improvement	3	- Small: After 4 weeks of participation in the program, you barely notice any reduction in your fatigue and/or improvement in your endurance. - Moderate: After 4 weeks of participation in the program you are less tired and can carry on with your daily activities longer and more easily. - Large: After 4 weeks of participation in the program you are barely tired anymore and can take up new activities in addition to your daily activities.
Type of guidance	3	- The exercise program is not adapted to your personal situation, no measurements have to be taken - The exercise program is partially adapted to your personal situation, some measurements (body weight, resting heart rate) must be performed - The exercise program is fully adapted to your personal situation, many measurements (motivation, blood pressure, exercise heart rate, cholesterol) must be performed
Deployment of the app	3	- You receive a weekly message on your phone - You receive a daily message on your phone - You receive multiple messages on your phone daily
Deployment of personal assistance	3	- You only have contact via the app - You only visit a coaching practice - You visit both a coaching practice and have contact through the app

2.1.3 Experimental design

An "experimental design refers to the process of generating specific combinations of attributes and levels that respondents evaluate in choice questions" (Johnson et al., 2013). For the experimental design SAS Macros was used to select random scenarios. A nearly orthogonal coding scheme was selected from the SAS-system based on the number of scenarios contained in the DCE of this study. Orthogonal, "meaning that each pair of levels appears equally often across all pairs of attributes within the design." (Johnson et al., 2013). The coding scheme ensures minimal overlap and level balance. "Balanced, meaning that each level appears equally often within an attribute". This means that there are no repetitions in the choice tasks, that all parameters are equally frequent independent and identifiable (Johnson et al., 2013). To avoid providing respondents with irrelevant choice tasks, adjustments were made in the coding scheme.

The decision was made to develop one questionnaire consisting of 18 choice tasks presented in 9 choice sets to keep it manageable for the respondents. The attribute list consists of 6 attributes, each with 3 discrete, categorical levels. Each question asks for 2 alternatives using six attributes, with each attribute having three levels (Johnson et al., 2013). In total, this yields 3x3x3x3x3x3=729 possible scenarios. Because the DCE design examines a large number of variables and presenting all combinations of alternatives is not feasible, a fractional factorial design was chosen (Vanniyasingam et al., 2016). Figure 2 shows an example of a DCE choice task from the questionnaire.

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 1 keer per week 45 tot 60 minuten achter elkaar	U sport 5 keer per week 20 tot 30 minuten achter elkaar
Soort activiteit	**Licht intensief:** Wandelen of Zwemmen	**Zwaar intensief:** Hardlopen, Aerobics of Wielrennen
Verbetering van de gezondheid	**Klein:** Na 4 weken deelname aan het programma merkt u nauwelijks vermindering van uw vermoeidheid en/of verbetering van uw uithoudingsvermogen	**Groot:** Na 4 weken deelname aan het programma bent u nauwelijks meer vermoeid en kunt u, naast uw dagelijkse werkzaamheden, ook nieuwe activiteiten oppakken.
Soort begeleiding	Het trainingsprogramma wordt **niet** aan uw persoonlijke situatie aangepast, er hoeven geen metingen worden uitgevoerd	Het trainingsprogramma wordt **volledig** aan uw persoonlijke situatie aangepast, er moeten veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd
Inzet van de app	U ontvangt **wekelijks** een bericht op uw telefoon	U ontvangt **dagelijks meerdere** berichten op uw telefoon
Inzet van persoonlijke begeleiding	U heeft alleen contact via de app	U bezoekt zowel een coachingspraktijk en u heeft contact via de app

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

* Figure 2. Example of DCE choice task

Instead of an opt-out choice in the choice task, a "dual-reponse none" was chosen. This approach works as follows: "Rather than ask respondents to choose among, say, four alternatives {A, B, C and None}; respondents are first asked to choose among alternatives {A, B, and C}, and then next asked if they really would buy the alternative, they selected in the first stage (yes/no)" (Sawtooth Software, n.d.). This option prevents respondents from saying "none" on many questions, which is not a good reflection of reality, nor does it provide insight into preferences. The dual-response none also ensures that no information is lost, by first having respondents choose between the possible options. However, it does have the disadvantage that respondents have to answer two questions per choice task instead of one (Sawtooth Software, n.d.; Bridges et al., 2011).

2.2. Study population

The questionnaire was carried out in July and September 2022. The study population consisted of people over the age of 18 with a chronic disease living in the Netherlands. The sample size depends on the complexity of the questionnaire, the availability of respondents, the desired accuracy, and the degree of heterogeneity in the population of interest. The ISPOR guideline recommends a sample size of 200-300 respondents. In contrast, 40% of published conjoint analysis studies have a sample size between 100 and 300 respondents. The rule of thumb proposed by Pearmain et al. suggests that, for DCE designs, sample sizes over 100 are able to provide a basis for modeling preference data (de Bekker-Grob et al., 2015). Therefore, the goal was to recruit 100 or more respondents through electronic administration over the Internet. Both private channels (e.g., WhatsApp, LinkedIn, Facebook) and patient groups (e.g., Facebook) were consulted (Bridges et al., 2011).

*Table 2; Eligibility criteria in study selection (Dintsios et al., 2018; Hoerster et al., 2020)

Criteria	***Inclusion***
Population	• Patients living in the Netherlands and speaking the language with all stages of chronic conditions • ≥18 years of age • able to participate fully in all research protocols/procedures, including informed consent
intervention	• Quantitative elicitation of preferences for lifestyle interventions • Quantitative methods for stated preferences (e.g., DCE)
Language	• Dutch

2.3 Questionnaire

A cross-sectional questionnaire was administered for approximately 2 months. In the first weeks of the questionnaire, sampling took place among family, friends and other members recruited through social media. To recruit more respondents people from a nursing home (rehabilitation and somatic wards), the researcher's workplace, were involved. However, this phase revealed that many nursing home respondents no longer have the ability to exercise and that elderly people from a nursing home is not a good target group for this research. In the subsequent phase, respondents were recruited through Facebook groups for people with chronic conditions. A flyer (Appendix A) was also designed and hung in a gym, the library and a dentist's waiting room to obtain an even larger sample. The flyer contains a Quick Response code (QR) that can be scanned to access the questionnaire. The questionnaire was completed individually via a web survey.

Some questionnaires were completed by the researcher together with a person from a nursing home, as the questionnaire could not be completed online. On average, it took the respondent 11.315 minutes to complete the questionnaire.

2.3.1 Socio demographic

The questionnaire consisted of four parts with a total of 25 multiple choice-questions. The first part included socio-demographics questions (e.g., age, gender, presence of chronic disease). Individuals who did not agree with the conditions, were under 18 years of age or did not have a chronic disease, were automatically excluded.

2.3.2 EQ-5D-5L

The second part of the questionnaire included the short version of the EQ-5D-5L, which was designed to measure respondents' reported health in a generic way. The questionnaire had the ability to compare patients' health with each other (Devlin et al., n.d.; van Reenen et al., n.d.). The EQ-5D-5L questionnaire contained 5 short descriptive questions consisting of 5 multiple-choice answers. The EQ-5D-5L aimed to provide a simple descriptive profile of the respondents' health status through scores on the five dimensions (mobility, self-care, usual activities, pain/discomfort, anxiety/depression). The health profile could be converted into a value on a scale with anchor points of 1 (means completely healthy) and 0 (means condition as bad as dead). For example, the index value of a respondent with an eq-5d-5l profile 11111 is 1.00, meaning that the respondent considers his health condition to be completely healthy and not limited by his illness (Devlin et al., n.d.).

The reported data from the EQ-5D-5L were intended for this study to gain insight into how respondents rated the severity of their chronic illness and whether there was a relationship between health level, person characteristics and preferences for exercise programs (Devlin et al., n.d.).

2.3.3 IPAQ-SF

The third part of the questionnaire included the International Physical Activity Questionnaire- Short Form (IPAQ-SF) as a validated questionnaire to estimate the physical activity level of the respondents. The short-form version contained 7 questions, all of which can be reported as a continuous measure (IPAQ., 2005).

The questionnaire recorded physical activity in the last 7 days for 4 intensity levels, namely sitting, walking, moderate-intensity, and vigorous-intensity activities. Respondents could indicate how often per week and how many hours and/or minutes they spend on physical activity.

Respondents could also indicate they were not physically active at that intensity level or that they could indicate they are not sure how much time they spend on it (see Appendix D for full questionnaire).

The scores could be summed to give a total score denoted in Metabolic Equivalent of Task (MET) minutes per week, which is a measure of the amount of energy which was expended while performing a particular physical activity. The total score indicated which category (e.g., low, moderate, high) a respondent was classified under (IPAQ., 2005).

The last part of the questionnaire included the 9 choice tasks of the discrete choice experiment, which is explained in the study design above.

2.4 Ethical considerations

During this study, in which respondents participated, some ethical considerations had to be made. In particular, the anonymity and the burden on the respondents were important ethical considerations. Respondents were given an introduction prior to completing the questionnaire which included the design and goals of this study. In addition, it was indicated that the results would be processed anonymously and could not be traced, that participation was voluntary, and that the respondent had the right to stop the questionnaire at any time. Thus, the law on privacy was observed. Furthermore, the study was approved by the Ethics Committee of the University of Twente. Since the questionnaire EQ-5D-5L was included, an agreement had to be made for the Terms of Use. An official license agreement was not necessary since the research was qualified as Non-Commercial.

2.5 Statistical analysis

The demographics, including age, gender, and the presence of a chronic disease, of the sample were analyzed by descriptive methods.

The scoring method that was used for the IPAQ questions in the questionnaire is based on the ´IPAQ scoring protocol´ (Cheng., n.d.). The official website of the IPAQ was used for the analysis, which offers an excel file which automatically calculates the results of the IPAQ. In the Excel file, only raw data had to be entered from all respondents, after which Excel calculates the final MET-minutes and categorical scores.

To determine the index values of the EQ-5D-5L data, the excel file "EQ-5D-5L Index Value Calculator" developed by the EuroQol Group was used (van Hout et al., 2012). Responses to the EQ-5D-5L questionnaire were coded to describe the health status of the respondent. For example, 21111 means mild problems in the mobility dimension and no problems in any of the other dimensions. A value set was associated with this code, which was used for cluster analysis.

The DCE data recruited through Qualtrics was analyzed with the software RStudio with the aim of exploring relationships between variables through A multinomial logit analysis, to obtain utilities and to test the hypotheses. The analysis of a discrete choice model was based on the econometric model by McFadden and Lancaster's demand theory which suggests that "an individual derives utility from choosing an alternative", and it is based on the Random Utility Theory which suggests that "an individual selects the alternative where maximum utility can be expected" (McFadden., 1973; Lancaster., 1966). Due to this assumption, the utility equation for the choice of an exercise program can be used.

$$U = \alpha + \beta\text{intensity} + \beta\text{activity type} + \beta\text{health improvement} + \beta\ \text{Type of guidance} + \beta\text{Deployment of the app} + \beta\text{Deployment of personal assistance} + \varepsilon$$

Where β is the coefficient indicating the utility per attribute level. α is the intercept based on the alternative specific constants. Unobserved factors (ε) also influence the decision to choose an alternative.

With the multinomial logit analysis, the attribute estimates (β-coefficients), standard errors were calculated. P-values were identified with the use of Z-tests, to determine whether the effect is significant. The significant level was set to $p<0,05$. Dummy-coding was applied, meaning that the reference level was set to 0, to be able to estimate the remaining levels. A positive β coefficient indicates that this attribute level derives positive utility. Conversely, a negative β-coefficient indicates that as the attribute level increases, utility is reduced.

With the use of the β-coëfficiënts, the relative importance of the attributes was calculated, by calculating for each attribute the difference between the highest and lowest utilities. By calculating this value and dividing it by the total of all attributes, the relative importance was calculated.

To answer research question 2, clusters were designed. Clusters are groups consisting of objects or individuals sorted according to their similarity on one or more dimensions and identifies groups that maximize similarity within the group and minimize similarity between groups (Pinto et al., 2019). The clusters were designed based on the EQ-5D scores. Respondents who scored low on the EQ-5D, and were severely limited, were sorted into one cluster and respondents who scored high on the EQ-5D and were lightly limited were included in the other cluster. Furthermore, it was examined whether there was a significant relationship between the individuals in these clusters and their demographic and health characteristics. This was done using a chi-square test in Excel. To determine the similarity and differences between the clusters regarding their exercise program preferences, multinomial logit analysis was performed for both clusters separately.

3. Results

Respondents' characteristics

In total, 99 respondents participated in this study, of which 61 completed the questionnaire in full. In the study, 45 (73.77%) women participated and 16 (36.23%) men. Most of the respondents suffer from a chronic disease other than those indicated. Common other conditions are thyroid disorders (5 respondents) and rheumatism/arthritis (7 respondents). The demographic variables are shown in Table 3. Furthermore, most people with chronic diseases participate in sports to stay fit and healthy (55.74%). Other leading reasons for exercising were for relaxation (42.63%) or to lose weight (21.31%), (31.15%) indicated that they do not play sports at all. Respondents could give an open answer why they participate in sports. Examples of answers included rehabilitation, for social contacts or as a mode of transportation.

Table 3. Demographic characteristics of the study population

	Total dataset (n= 61)	
	N	Percentage
Age		
<18	0	0,0%
18-35	21	34,4%
36-45	7	11,5%
46-55	17	27,9%
56-65	7	11,5%
66-75	5	8,2%
76-85	4	6,6%
86+	0	0,0%
Gender		
Male	16	26,2%
Female	45	73,8%
Different	0	0,0%
Chronic disease		
Diabetes	8	10,8%
Cardiovascular disease	7	9,5%
Asthma/COPD	12	19,7%
Else, namely...	45	73,8%
I prefer not to say	2	2,7%

3.1 Results research question 1

The overall utilities (β coefficients) of all attributes and their levels are shown in Table 4 and figure 3. The results show that adults with chronic diseases have the least preference for exercising 5 times a week for 20-30 minutes at a time ($p<0.001$). In contrast, respondents preferred exercising 3 times per week 30-45 minutes at a time. However, this effect is not significant ($p>0.05$). Heavy exercise is not preferred by respondents ($p=0.02$) compared to light to moderate exercises. Furthermore, respondents indicated a preference for an exercise program that leads to health gains as opposed to an exercise program that does not lead to health gains ($p<0.001$). Moreover, respondents with chronic diseases do not prefer an app that is fully customized. They appreciate not having to take measurements (e.g., motivation, blood pressure, heart rate while exercising, cholesterol). In addition, respondents also do not need an app in which they receive multiple messages daily. However, it does not indicate a significant relationship ($p=0.16$). Finally, respondents preferred both coaching through the app and face-to-face at a coaching practice. Compared to face-to-face coaching only at a coaching practice, respondents prefer to receive coaching through the app.

*Table 4 Importance of the attributes and their relative importances according to multinomial logit analysis

Attributes	***Coefficients***	***SE***	***P-value***	***Relative importance***
Intensity				25%
*You exercise once a week for 45 to 60 min.	0	0	0	
*You sport 3 times a week 30 to 45 min.	0.167	0.155	0.282	
*You sport 5 times a week 20 to 30 min.	-0.738	0.159	0.000	
Activity type				10%
*Lightly intensive	0	0	0	
*Moderately intensive	-0.043	0.153	0.780	
*Vigorously intensive	-0.369	0.160	0.028	
Health improvement				26%
*Small	0	0	0	
*Moderate	0.933	0.161	0.000	
*Large	0.812	0.158	0.000	
Type of guidance				7%
*The training program is not adapted to your personal situation	0	0	0	
*The training program will be partially adapted to your personal situation	-0.116	0.161	0.471	
*The training program will be fully adapted to your personal situation	-0.264	0.159	0.096	
Deployment of the app				17%
*You will receive a weekly message on your phone	0	0	0	
*You receive one message daily on your phone	-0.612	0.160	0.000	
*You receive multiple messages on your phone daily	-0.218	0.155	0.159	
Deployment of personal assistance				14%
*You only interact via the app	0	0	0	
*You only visit a coaching practice	-0.154	0.167	0.357	
*You visit both a coaching practice and you have contact through the app	0.337	0.153	0.027	

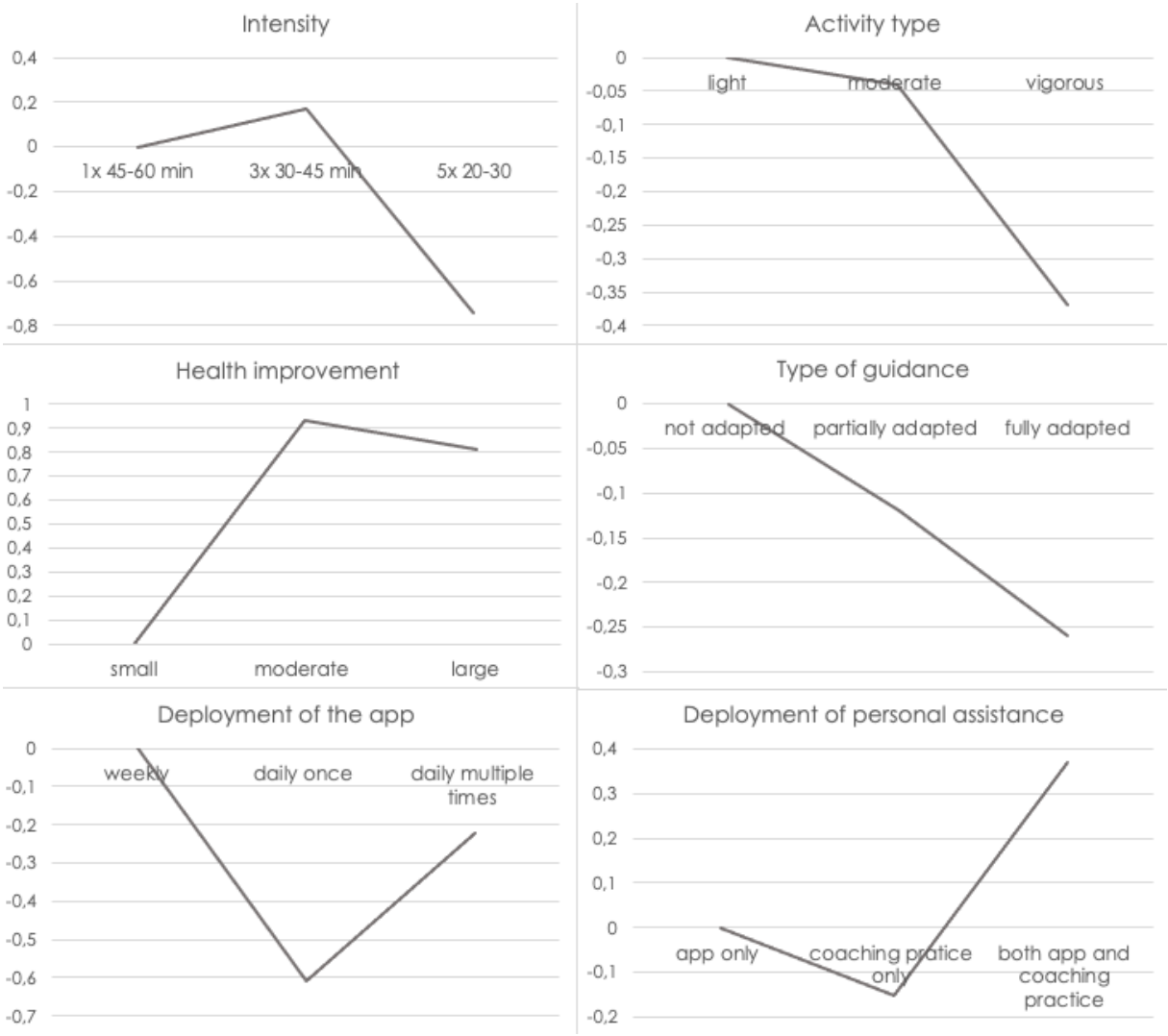

*Figure 3. Preference weights per attribute level

The multinomial logit analysis in R of the discrete choice experiment shows that the sample attached the highest relative importance (RI 26.1) to the attribute "health improvement", compared to the other attributes (Table 4). The attribute that was reported to be the second-most important is intensity (RI 25,3). The next most important attribute is deployment of the app (RI 17,1). Attributes of a coaching app that have less importance are deployment of personal assistance (RI 13,7) and activity type (RI 10.3). The analysis shows that the attribute "type of guidance" was given the least importance (RI 7,4), compared to the other attributes.

Table 5 shows the probability of the respondent choosing for an exercise program. 63% of the respondents are likely to choose exercise program 2, which involves exercising 5 times a week for 20 to 30 minutes at a time, with light-intensity exercises, leading to large improvement of health, in which the program is not personalized, and in which coaching takes place face-to-face in a coaching practice. The probability of exercise program 1 being chosen by respondents is approximately 37%

*Table 5. Example of probabilities respondents choosing for an exercise program

Exercise program 1	Utility	Exercise program 2	Utility
You sport 3 times a week 30 to 45 min	0.17	You sport 5 times a week 20 to 30 min	-0.74
Vigorously intensive	-0.37	Lightly intensive	0
Moderate improvement in health	0.93	Large improvement in health	0.81
Fully adapted to your personal situation	-0.26	Not adapted to your personal situation	0
Weekly messages	0	Weekly messages	0
You only interact via the app	0	You only visit a coaching practice	-0.15
Total utility:	0,47		-0,08
Share of Preference:	37%		63%

3.1.1 Dual-Response None

After the respondents indicated their preference for an exercise program, they were asked whether in reality they would follow the chosen program. 6 respondents (9.84%) would not follow the chosen exercise program in any case. 5 (8,20%) respondents would opt to follow 2 out of 9 exercise programs, while 9 respondents (14.75%) would follow all the chosen programs in reality. The respondents who chose not to participate in the exercise program in any case had a mean EQ-5D-5L score of 0.6383 (below the mean of all respondents 0.735) and an IPAQ-category of 2.333 (below the mean of all respondents 2.377). It can be concluded that the respondents who are not able, or do not have the willingness to participate in an exercise program do score below average on their self-reported health status and self-reported level of physical activity. Figure 4 describes the percentage of participants per choice task who indicated they did not want to participate (opt-out) in an exercise program. Choice tasks 3, 6 and 8 have a high frequency, which means that many respondents will not follow these exercise programs. These choice tasks mainly contain the trade-off exercising 5 times a week 20 to 30 min on a low intensity scale or exercising once a week but on a vigorously intensive level. In particular, these are also the levels through which the least utility is experienced (table 4; figure 3).

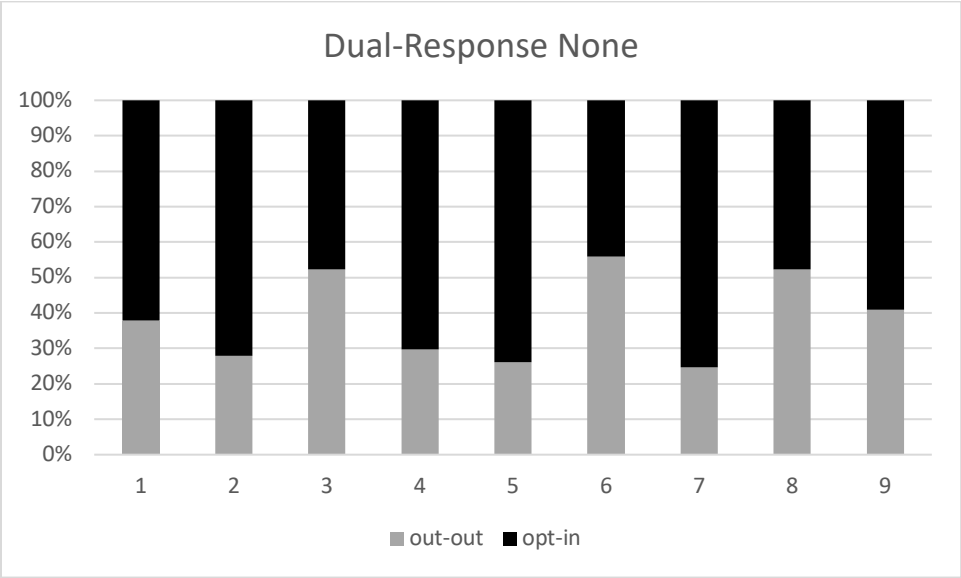

*Figure 4. Frequency of opt-out and opt-in in an exercise program per choice task

3.2 Results research question 2

From the EQ-5D-5L index values, clusters can be identified. In total, 2 clusters were created based on the EQ-5D scores. The respondents who belong to the clusters were examined in terms of their age and gender, what chronic disease(s) they have and in which category of the IPAQ they fit. These findings may provide insight on whether persons who have the same person characteristics experience the same or different underlying levels of poor health. Table 6 shows the details of this.

The first cluster includes 32 respondents who scored lowest on the EQ-5D questions. 21,9% of this cluster are 56 years of age or older. Cluster 2 includes individuals who report their health status as lightly limited. This cluster contains 29 respondents of which 31,0% are 56 years or older than 56. It can be concluded from Table 7 that there is no significant effect (p=0,33) between the respondents from the 2 clusters and their age.

Out of all male respondents (16), 13 (81,3%) are in cluster 2. Most female respondents are in cluster 1 (53.3%). As a result, there is a significant relationship (p<0.002) between gender and respondents from the clusters.

Among all respondents with diabetes, 75,0% were classified in cluster 2, meaning they were lightly limited in their daily lives. Similarly, cluster 2 contains the largest percentage (57.1%) of respondents with cardiovascular disease. Most Asthma/COPD respondents (60,0%) of this study are sorted in cluster 1, indicating that they feel severely limited in daily life. Among respondents with other chronic diseases, the largest proportion (58,7%) are in cluster 2. Since this study includes respondents suffering from more than 1 chronic disease, it is impossible to conclude whether there is a significant relationship.

Furthermore, Table 6 shows that although respondents from cluster 1 are severely limited in their daily lives, 50,0% still participate in high-intensity sports (IPAQ category 3). Also, among the respondents from cluster 2, the majority participates in high-intensity sports (48.1%, 76.0%). However, table 7 shows that there is no significant correlation between the IPAQ-categories and the EQ-5D scores.

*Table 6. Overview cluster analysis

	Cluster 1 (severely limited) n= 32	***Cluster 2 (lightly limited) n= 29***
Age		
18-35	12 (37,5%)	9 (31,0%)
36-45	6 (18,8%)	1 (3,4%)
46-55	7 (21,9%)	10 (34,5%)
56-65	3 (9,4%)	4 (13,8%)
66-75	3 (9,4%)	2 (6,9%)
76-85	1 (3,1%)	3 (10,3%)
Gender		
Male	3 (9,4%)	13 (44,8%)
Female	29 (90,6%)	16 (55,2%)
I prefer not to say	0 (0,0%)	0 (0,0%)
Chronic disease		
Diabetes	2 (6,3%)	6 (20,7%)
Cardiovascular disease	3 (9,4%)	4 (13,8%)
Asthma/COPD	6 (18,8%)	4 (13,8%)
Else, namely...	27 (84,4%)	19 (65,5%)
I prefer not to say	1 (3,1%)	1 (3,4%)
IPAQ category		
1	9 (28,1%)	4 (13,8 %)
2	7 (21,9%)	5 (17,2 %)
3	16 (50,0%)	20 (69,0 %)

*Table 7. Chi-Square Test

	p-value	significant (yes/no)
Age vs. cluster 1,2	0,332490002	No
Gender vs. cluster 1,2	0,00166911	Yes
IPAQ-category vs. cluster 1,2	0,278106206	No

Furthermore, it was analyzed whether respondents from the clusters also had similar preferences for an exercise program. For each cluster, based on the EQ-5D scores, the multinomial logit analysis was used to analyze whether the preferences between the two clusters were different or similar (Table 7). The results showed that respondents from cluster 1 (severely limited due to their chronic disease) preferred to exercise once a week for 45-60 minutes at a time, while respondents from cluster 2 (mildly limited due to their chronic disease) preferred to exercise 3 times a week for 30-45 minutes at a time. Both clusters least prefer to exercise 5 times a week. For the attribute 'activity type', the respondents from cluster 1 prefer light-intensity exercise, while the respondents from cluster 2 prefer moderate-intensity exercise. Also, for this attribute, both respondents from cluster 1 and respondents from cluster 2 have the least preference for heavy-intensity training. Furthermore, respondents from both clusters prefer moderate health improvement, as opposed to small or large health improvement. Both clusters prefer a coaching app that is not fully customized and only provides weekly messages. To conclude, respondents from both clusters prefer receiving coaching both through the app and in a coaching practice, as opposed to only visiting a coaching practice.

*Table 8. Preference weights of the attribute levels by cluster

Attributes	***Coefficients cluster 1***	***Coefficients cluster 2***
Intensity		
*You exercise once a week for 45 to 60 min.	0	0
*You sport 3 times a week 30 to 45 min.	-0.09764371	0.4510563
*You sport 5 times a week 20 to 30 min.	-0.90844279	-0.5672624
Activity type		
*Lightly intensive	0	0
*Moderately intensive	-0.24588256	0.1765734
*Vigorously intensive	-0.38298121	-0.3693387
Health improvement		
*Small	0	0
*Moderate	1.25173250	0.5973283
*Large	1.12431450	0.4821171
Type of guidance		
*The training program is not adapted to your personal situation	0	0
*The training program will be partially adapted to your personal situation	-0.03761952	-0.1984305
*The training program will be fully adapted to your personal situation	-0.10238878	-0.4451155
Deployment of the app		
**You will receive a weekly message on your phone*	0	0
**You receive one message daily on your phone*	-0.67886329	-0.5446055
**You receive multiple messages on your phone daily*	-0.22502290	-0.2147373
Deployment of personal assistance		
**You only interact via the app*	0	0
**You only visit a coaching practice*	-0.07407437	-0.2407371
**You visit both a coaching practice and you have contact through the app*	0.50191989	0.1572408

4. Discussion

This chapter discusses the results of this study. First, the findings regarding preferences for an exercise program are presented and compared to findings from other studies. Furthermore, the results of the second research question are discussed. Additionally, the study's strengths and limitations are examined. Finally, aspects that still require future research are discussed.

4.1 Study findings

The objective of this study was to investigate the preferences of people with chronic conditions toward e-coaching to contribute to a project that aims to improve patient-centered health care and encourage the adoption of a healthy lifestyle. The data analysis from the questionnaire reveals that the attribute "health improvement" has the greatest relative importance of all the other attributes. This means that in the future, if an e-health app is designed to stimulate people with chronic diseases to exercise more, health improvement should be an important feature of the app. It is proven that the willingness to participate in an exercise program is increased as individuals receive a reward (e.g., health benefits) for it (Paul et al., 2021: Aboagye et al., 2017: Gils et al., 2011).

The second most important feature an app should include is intensity. People with chronic diseases most prefer to exercise 3 times a week for 30-45 minutes at a time and least prefer to exercise 5 times for 20-30 minutes. Hypothetically, it was expected that individuals indeed prefer to exercise 1-2 times a week rather than 4-5 times a week, however, they prefer short (20-30 min) exercise sessions over long exercise sessions (45-60 min) (Beaudart et al., 2022; Geidl et al., 2018). In contrast to intensity, activity type is seen as a less important feature. Respondents prefer light-intensity exercise to vigorous-intensity exercise. The least important feature for the app, according to the analysis, is "type of guidance," with respondents preferring an app that is rather not than fully customized to their personal situation and does not require personal measurements. This result is contradictory to that literature that says that an e-health intervention for physical activity is considered motivating if it is personalized and tailored (Martin et al., 2020). Furthermore, respondents appreciate having contact with a supervisor partly through the app and partly face-to-face in a coaching practice. Only contact with a supervisor in a coaching practice is valued the least. Lastly, respondents prefer to receive weekly messages from the app, rather than daily. Hypothetically, people were expected to prefer receiving messages delivered regularly via telephone and to prefer independent practice with little instruction (Wilcox et al., 1999).

Furthermore, this study aimed to identify clusters consisting of respondents with similarities their demographics, health characteristics and preferences for an exercise program. The two clusters, based on low and high EQ-5D scores, showed that the age of the respondents did not have a significant relationship with the degree to which a person is limited in everyday life, whereas hypothetically this was expected (Emrani et al., 2020). However, a significant relationship was found between the clusters and the gender of the respondents. Almost all male respondents (81.3%) were included in the second cluster, implying that they felt lightly limited in daily life due to their chronic disease. Furthermore, the cluster analysis revealed that 75% of respondents with diabetes were in cluster 2. Most Asthma/COPD respondents (60.0%) of this study are sorted in cluster 1. However, it has not been shown whether there is a significant effect between the clusters and the chronic diseases.

Although respondents from cluster 1 are severely limited in their daily lives, half of them still exercise at a high intensity level (IPAQ-category 3). Similarly, of the respondents from cluster 2, the majority (69,0%) exercises with a high-intensity level. However, there does not appear to be a significant relationship

However, each cluster contained on average 31 (MIN=29, MAX=32) respondents which is too few for a proper analysis among subgroups of respondents (van Gils et al., 2011). For example, the first cluster contained only 2 persons with diabetes. Also, the results are different if the cluster is based on a different variable (e.g., IPAQ).

Besides comparing the clusters on similarities between the demographic and health characteristics, the study also examined whether the clusters differed in preferences for physical activity e-coaching. As a result, cluster 1 differed from cluster 2 with regard to the intensity of an exercise program. The respondents from who are severely limited (cluster 1) in daily life prefer to exercise once a week for 45-60 minutes at a time, while the respondents who are mildly limited (cluster 2) by their chronic disease preferred to exercise 3 times a week for 30-45 minutes at a time. Similarly, respondents from cluster 1 prefer light-intensity exercise, while the respondents from cluster 2 prefer moderate-intensity exercise. Furthermore, the clusters do not differ in their preferences for health improvement, type of guidance, deployment of the app and deployment of personal assistance. Both clusters prefer moderate health improvement, a coaching app that is not fully customized, an app who sends weekly messages and provides coaching both through the app and in a coaching practice.

4.2 Strengths and limitations

Chosen attributes from the DCE are based on similar studies and desires of the clients of this study. Whether all relevant attributes were included in this study is a point of uncertainty. The study by Aboagye et al, found that incentives can have a positive influence on health-related behaviors and choices (Aboagye et al., 2017). Incentives were expressed in this study by the attribute "improvement of health state."

It is possible that the trade-off for respondents would have been clearer with financial incentives and would have influenced their choice. Possible attribute levels could then have been discount coupons for fitness, wellness subsidies, and no incentive (Aboagye et al., 2017). Incidentally, it can be inferred from the results of the model that the coefficients of the attribute 'health improvements' have the largest preference weight and it is therefore an important component for a trade-off.

Another point to consider is that there is a risk that respondents may simplify a scenario by not weighing all attributes against each other, but only some key attributes. This was tried to avoid by not selecting many attributes and keeping the number of levels the same for each attribute.

Another possible limitation of this study is that the questionnaire was relatively long with a high information density, which may lead to a high respondent burden. The completion rate was (61/99, 61.6%). To avoid too high respondent burden, the number of questions in the questionnaire were reduced to the maximum by adding short versions of existing questionnaires (e.g., IPAQ, EQ-5D-5L). Also, the skip logic function was added so that respondents only had to answer questions that were relevant to them. Nevertheless, the average time to complete the questionnaire was 11.315 min.

Due to the modest sample size (n=61) of this questionnaire, a threat of "low statistical power" may occur. According to Johnson's thumb rule, at least 100 respondents were actually needed for a proper analysis at the number of DCE questions (e.g., 9 choice tasks) (Johnson et al., 2013). Incidentally, respondents were included from the nursing home who were chronically ill, but no longer exercised, only did bits of walking. Better consideration could have been given to specifying the chosen target group (e.g., adults over 18 years) to adults between 18 and 69. This is the target group for which the IPAQ is suitable (IPAQ., 2005).

The experimental design also includes some limitations. The experimental design of this study is recognized as balanced due to each level occurring equally often in the design, but it is not completely orthogonal because not every pair of levels occurs equally often within the design. In addition, it was decided to make adjustments in the design of SAS macros because it outlined scenarios that did not fit reality (e.g., 5 times exercising with a small

health gain or 1 time exercising with a large health gain). This has caused the experimental design to become less efficient. Furthermore, the experimental design contains dominant choice sets. Dominant choice sets were found to have a negative impact on responses, statistical power and inconsistent with random utility theory (Jonker et al., n.d.). Another limitation of the experimental design is that 9 choice tasks were chosen to avoid an excessively long questionnaire. Within these 9 choice tasks 18 parameters (6 attributes with 3 levels each) are measured. For an efficient design, different sets of choice tasks (blocks) should have been asked. Because only a fraction of all possible scenarios (fractional factorial design) was used in this DCE, statistical efficiency may have been compromised and wrong conclusions may have been drawn. Thus, a less efficient design requires a larger sample size (Vanniyasingam et al., 2016).

Lastly, the efficiency of this study also depends on reponse efficiency. Measurement errors were found due to inattention of the respondent (e.g., for the IPAQ questions, a few respondents indicated 30 minutes of exercise, but forgot to indicate on how many days they did this, causing the IPAQ category to be possibly incorrect). Other possibility that may have led to response inefficiency are response fatigue due to the high information density, which can lead to a high respondent burden. Furthermore, respondents may be confused by the interpretation of definitions. The attribute list of the DCE section contains characteristics that can be interpreted differently, such as 'improvement of health'. However, it was chosen to describe the attribute levels in the choice tasks comprehensively and with specific explanations to reduce the chance of misinterpretation. This study formulated the characteristic "improvement in health" very specifically, while other studies often used fewer specific descriptions (e.g., "Small relief in discomfort, small increase in strength and ability to move") (Paul et al., 2021; Pinto et al., 2019).

4.3 Future research

Future follow-up research could be done with a larger sample size and with a questionnaire that randomly assigns different sets of choice tasks (blocks) to respondents. In addition, the study population could be modified to include adults aged 18-69. Furthermore, the study population could be more specific to a particular chronic disease, for example, DM. Prior to the questionnaire, a small study could first be done with focus groups. By discussing with a selective group what relevant attributes and attribute levels are, their interests can be included in the questionnaire. Incidentally, this information also could be used to set expectations. Moreover, another possible method is to conduct a pilot study, which can serve as preliminary information for constructing an efficient design. From the pilot study it can be deduced what impression the questionnaire leaves on the respondent (e.g., respondent burden, interpretation of questions) (Traets et al., 2020).

5. Conclusion

This study shows that to encourage physical activity in people with chronic disease(s), an app should be developed that rewards participants for their physical activity. Participants are more willing to be active if they derive health benefits from it. It is recommended to develop exercise programs appropriate to the degree of limitation individuals experience due to their chronic disease. The individuals in this study who are severely limited in their daily lives prefer exercise once a week, at a low intensity. While the respondents in this study who are lightly limited prefer an app where exercise can be done 3 times per week at a moderate-intensity level. Furthermore, app participants prefer to receive multiple messages weekly rather than daily. The study also suggests that the app need not match the personal situation of participants with chronic illnesses. Finally, participants prefer to be coached both via the app and face-to-face in a coaching practice.

There were no correlations between respondents with the same underlying health level and their age, chronic disease or their level of physical activity in the past 7 days. However, a significant correlation was found between respondents' gender and the clusters into which they were assigned. Nearly all male respondents in this study reported being lightly limited in daily living.

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Appendix A – flyer with an QR-code to recruit respondents

Appendix B – Search strategy

Steps literature search		
1. Find out the search terms	Preferences, physical activity, coaching, chronic diseases, discrete choice experiment	
2. Synonyms (MeSH function PubMed)	Chronic diseases	• Disease, Chronic • Chronic Illness • Chronic Illnesses • Illness, Chronic • Chronic Condition • Chronic Conditions • Condition, Chronic • Chronically Ill
	Patient preferences	• Patient Preferences • Preference, Patient • Preferences, Patient
	Physical activity	• Exercises • Physical Activity • Activities, Physical • Activity, Physical • Physical Activities • Exercise, Physical • Exercises, Physical • Physical Exercise • Physical Exercises • Acute Exercise • Acute Exercises • Exercise, Acute • Exercises, Acute • Exercise, Isometric • Exercises, Isometric • Isometric Exercises • Isometric Exercise • Exercise, Aerobic • Aerobic Exercise • Aerobic Exercises • Exercises, Aerobic • Exercise Training • Exercise Trainings • Training, Exercise • Trainings, Exercise
	App	• Application, Mobile • Applications, Mobile • Mobile Application • Mobile Apps • App, Mobile • Apps, Mobile • Mobile App • Portable Software Apps

		• App, Portable Software • Portable Software App • Software App, Portable • Portable Software Applications • Application, Portable Software • Portable Software Application • Software Application, Portable • Smartphone Apps • App, Smartphone • Apps, Smartphone • Smartphone App • Portable Electronic Apps • App, Portable Electronic • Electronic App, Portable • Portable Electronic App • Portable Electronic Applications • Application, Portable Electronic • Electronic Application, Portable • Portable Electronic Application
MeSH Advanced Search Builder	(((conjoint analysis) AND (physical activity OR exercises OR "physical activities" OR "physical exercises")) AND (chronic diseases OR "chronic illnesses" OR "chronic conditions")) (((discrete choice experiment) AND (physical activity OR exercises OR "physical activities" OR "physical exercises")) AND (chronic diseases OR "chronic illnesses" OR "chronic conditions")) AND (app OR "mobile app" OR "mobile application") (((discrete choice experiment) AND (physical activity OR exercises OR "physical activities" OR "physical exercises")) AND (chronic diseases OR "chronic illnesses" OR "chronic conditions"))	Google Scholar 19300 → (Brown et al., 2009; de Guzman et al., 2015; de Rosis et al., 2020; Dintsios et al., 2018; Pinto et al., 2019; Ramirez et al., 2016) Findut 64 → (Aboagye et al., 2017; Brown et al., 2009) Pubmed 0 Google scholar 17000 → (de Rosis et al., 2020) Pubmed 0 FindUT 75 Scopus 0 Google scholar 52.300 → (Ramirez, 2015)(veldwijk et al, 2013) Findut 227 → (Aboagye et al., 2017; Cranen et al., 2017; Ramirez et al., 2016) Pubmed 9→ (Cranen et al., 2017)
Filter	(((discrete choice experiment [Title/Abstract]) AND (physical activity[Title/Abstract] OR exercises[Title/Abstract] OR "physical activities"[Title/Abstract]	

	OR "physical exercises"[Title/Abstract])) AND (chronic diseases[Title/Abstract] OR "chronic illnesses"[Title/Abstract] OR "chronic conditions"[Title/Abstract])) AND (app[Title/Abstract] OR "mobile app"[Title/Abstract] OR "mobile application"[Title/Abstract] "mobile application")	

Appendix C – Review attribute list

Article	*Attributes*	*Levels*
(Veitch et al., 2021)	Usual activity levels	- mostly sitting, mostly light activities, mostly moderate activities, mosty vigorous activities
	Usual activites performed	- walk, run, ball games, ride bike, watch tv
	Number of days of ≥60 mins physical activity per day in usual week	- <7 days/week, 7 days/week
(de Guzman et al., 2015)	Time of day	- AM/PM
	Duration	- Less than 30 min/more than 30 min
	Frequency	- Everyday/twice a week/ thrice a week
	Venue (location)	- Indoor/outdoor
	Type of physical activity	- Light activity/moderate/vigorous
(Brown et al., 2009)	Number of walking days per week for 3 months	- 3 days/2 days
	Walking time per day	- 45 minutes/75 minutes
	Walking setting	- On your own or with an informal group
(Aboagye et al., 2017)	Type of training	- strength, cardio, mindfulness
	Design	- Individual with supervision, individual without supervision
	Intensity	- Low, medium, high
	Frequency	- Once a week, two times per week, three times per week
	Proximity	- 10 minutes, 20 minutes, 30 minutes
(Beaudart et al., 2022)	Physical activity	- Not included, Walking for 15–20 min, 1–2 times per week (or equivalent physical activity such as jogging, climbing stairs, playing sports, doing aerobics or dancing), Walking for 30–40 min, 3–4 times per week (or equivalent physical activity)
(Geidl et al., 2018b)	Social situation	- Participating alone, with a partner, in a group with healthy people, in a group with patients that have similar health issues
	Location	- Participating a home, local offer outside home
	Type of exercise	

	Intensity	- Endurance, muscular strength, neuromuscular and flexibility, mixed program
	Frequency	- Light activity, Moderate activity, Vigorous activity
	Duration	- 1-2 sessions per week, 3 sessions per week, 4-5 sessions per week - 20-30 minutes per session, 45-60 minutes per session
Cranen et al., 2017	Physician contact mode	- All physician contact takes place at the clinic face-to-face, One quarter of your physician contact through Web camera, Three-quarters of your physician contact through Web camera, All your physician contact takes place through Web camera
(Ramirez et al., 2016)	Physical activity goal setting	- Patient's doctor recommends physical activity goals, Patient selects his or her own personalized physical activity goals
	Feedback on physical activity performance	- Patient receives feedback on his or her individual performance, Patient's performance is compared with that of other patients
	Physical activity behavior-change education	- Patient's doctor recommends the educational content, Patient specifies the type of educational content he or she wants to receive
	Frequency of messaging	- Patient's doctor recommends how often patient should receive messages - Patient specifies how often he or she wants to receive messages
	Social support	- Family members learn how to offer support, Patient meets other patients so they can support one another
Pinto et al., 2019	Health benefits	- Low, medium, high
	Enjoyment	- Low, medium, high
	Convenience	- Low, medium, high
	Physical activity effort	- Low, medium, high
	Monthy cost	- Low, medium, high
	Time per physcial activity occasion	- Low, medium, high
(van Gils et al., 2011)	Time spent on the program	- 2,5 hours per week, 4 hours per week
	Arrangement physical activity lessons	

	Group activity	- Individually with men and women, With people of the same gender
	Sports activity	- Only with people without diabetes, Only with other diabetes patients
	Counselling	- Walking/cycling, Fitness (treadmill, rowing machine, bicycle)
	Money	- None, Physical therapist/sports teacher - Copayment = €500 per year, Copayment = €327.50 per year, Copayment = €155 per year, Copayment = €0 per year, Bonus = €0 per year, Bonus = €155 per year, Bonus = €327.5 per year, Bonus = €500 per year
(Paul et al., 2021)	Exercise type	- Dance program, balance exercise program, muscle strength exercise program, aerobic exercise program, walking exercise program, multimodal exercise program
	Number of 45-minute exercise sessions per week	- 1x 45-minutes, 2x 45-minutes, 3x 45-minutes, 4x 45-minutes
	Exercise location	- At home, In the local neighbourhood, At a hospital or health centre/practice, At a community centre or facility, At multiple locations including home, At multiple locations excluding home
	Travel time per exercise session	- Less than 5 minutes each way travel time, 5 minutes, 10 minutes, 15 minutes, 30 minutes, 60 or more minutes
	Exercise delivery mode: individual and/or in a group of two or more people	- Individual session, group session, individual plus group session
	Supervisor's expertise	- There is no one supervising the exercise, Supervised by a family member, friend or carer, Supervised by a fitness, exercise or dance instructor without specific expertise in Parkinson's disease, Supervised by a fitness, exercise or dance instructor with specific expertise in Parkinson's disease, Supervised by a physiotherapist without specific expertise in Parkinson's disease, Supervised by a physiotherapist with specific expertise in Parkinson's disease
	Amount f supervision	

	- All of the exercise is supervised, Some of the exercise is supervised, None of the exercise is supervised
The effect on your Parkinson's disease motor symptoms and physical function	- No improvement, small improvement, moderate improvement, large improvement
Effect on your overall feeling of wellbeing	- No improvement, small improvement, moderate improvement, large improvement
Out of pocket cost (in AU$) including travel costs per session	- $0 per session, $10 per session, $25 per session, $50 per session, $100 per session, $150 per session

Appendix D – Full questionnaire

Beste heer/mevrouw,

Met deze vragenlijst willen wij er graag achter komen wat het beste trainingsprogramma is voor mensen met een chronische ziekte. De resultaten van dit onderzoek worden gebruikt om een app te ontwikkelen, met als doel om mensen met een chronische ziekte meer te laten bewegen. Dit kan ervoor zorgen dat mensen minder klachten ervaren.

Om de app aan te laten sluiten bij uw wensen, zijn wij geïnteresseerd in uw mening.

De vragenlijst bestaat uit 2 onderdelen. Bij het eerste onderdeel worden er een aantal vragen gesteld over u als persoon en over hoeveel u beweegt. Bij het tweede onderdeel stellen wij u een aantal vragen waarin twee mogelijke trainingsprogramma's worden beschreven. Uit deze twee trainingsgprogramma's vragen wij u te kiezen voor het programma die u het beste vindt.

De vragenlijst bestaat uit 25 vragen. Het invullen van de vragenlijst zal ongeveer 15 minuten duren. De balk bovenaan geeft aan hoe ver u bent. U gaat naar de volgende vraag door op de pijl onderin beeld te klikken.

Wij hopen u hiermee voldoende te hebben geïnformeerd en willen u bedanken voor uw deelname aan dit onderzoek.

Vragen?
Mocht u nog vragen of opmerkingen hebben over het onderzoek, neem dan contact met mij op via a.leusink@student.utwente.nl

Contactpersoon: Aniek Leusink
Master student Health Sciences, Universiteit Twente

Toestemming
• Het meedoen aan deze vragenlijst is vrijwillig en u mag op elk moment stoppen met het invullen.
• Uw gegevens worden anoniem verwerkt.
• Uw informatie kan anoniem gebruikt worden voor wetenschappelijke artikelen van onderzoekers.
• Uw informatie kan anoniem gebruikt worden voor eventueel toekomstig onderzoek.
• U bent 18 jaar of ouder.

Heeft u al het bovenstaande gelezen en stemt u in met het meedoen aan de vragenlijst?

- Ja, ik ga akkoord
- Nee, ik ga niet akkoord

Wat is uw leeftijd?
- <18
- 18-35
- 36-45
- 46-55
- 56-65
- 66-75
- 76-85
- 86+
- Wil ik liever niet zeggen

Waarom doet u aan sport? Meerdere antwoorden zijn mogelijk.
- Als onderdeel van mijn werk
- Ontspanning
- Afvallen
- Fit en gezond blijven
- Ik doe niet aan sport
- Anders, namelijk…

Heeft u een chronische ziekte?
- Ja
- Nee
- Wil ik liever niet zeggen

Welke chronische ziekte heeft u? Meerdere antwoorden zijn mogelijk.
- Diabetes
- Hart- en vaatziekte
- Astma/COPD
- Anders, namelijk;
- Wil ik liever niet zeggen

In dit deel van de vragenlijst wordt naar uw gezondheid van VANDAAG gevraagd. Wilt u elke vraag beantwoorden door het juiste hokje aan te kruisen. Wanneer u twijfelt over het antwoord op een vraag, probeer dan het antwoord te geven dat het meest van toepassing is.

Mobiliteit
- Ik heb geen problemen met lopen
- Ik heb een beetje problemen met lopen
- Ik heb matige problemen met lopen
- Ik heb ernstige problemen met lopen
- Ik ben niet in staat om te lopen

Zelfzorg

- Ik heb geen problemen met mijzelf wassen of aankleden
- Ik heb een beetje problemen met mijzelf wassen of aankleden
- Ik heb matige problemen met mijzelf wassen of aankleden
- Ik heb ernstige problemen met mijzelf wassen of aankleden
- Ik ben niet in staat mijzelf te wassen of aan te kleden

Dagelijkse activiteiten (bijv. werk, studie, huishouden, gezins- en vrijetijdsactiviteiten)

- Ik heb geen problemen met mijn dagelijkse activiteiten
- Ik heb een beetje problemen met mijn dagelijkse activiteiten
- Ik heb matige problemen met mijn dagelijkse activiteiten
- Ik heb ernstige problemen met mijn dagelijkse activiteiten
- Ik ben niet in staat mijn dagelijkse activiteiten uit te voeren

Pijn/ongemak

- Ik heb geen pijn of ongemak
- Ik heb een beetje pijn of ongemak
- Ik heb matige pijn of ongemak
- Ik heb ernstige pijn of ongemak
- Ik heb extreme pijn of ongemak

Angst/somberheid

- Ik ben niet angstig of somber
- Ik ben een beetje angstig of somber
- Ik ben matig angstig of somber
- Ik ben erg angstig of somber
- Ik ben extreem angstig of somber

We willen weten hoe goed of slecht uw gezondheid VANDAAG is. Deze meetschaal loopt van 0 tot 100. 100 staat voor de beste gezondheid die u zich kunt voorstellen. 0 staat voor de slechtste gezondheid die u zich kunt voorstellen. Markeer een X op de meetschaal om aan te geven hoe uw gezondheid VANDAAG is. Noteer het getal waarbij u de X heeft geplaatst in onderstaand vakje.

	0 100
Uw gezondheid VANDAAG is ()	

Wij zijn geïnteresseerd welke vorm(en) van lichamelijke activiteit mensen verrichten in hun dagelijkse leven. De vragen gaan over uw lichamelijke activiteit **gedurende de afgelopen 7 dagen**. Beantwoordt u alstublieft alle vragen, ook al beschouwt u uzelf als niet lichamelijk actief. Denkt u aan activiteiten die u doet op het werk, in en rond het huis, om van de ene naar de andere plaats te komen en activiteiten in uw vrije tijd

voor recreatie, training of sport.

Denkt u aan alle zware lichamelijke activiteiten die u deed in de **afgelopen 7 dagen. Zware** lichamelijke activiteiten zijn activiteiten die veel lichamelijke inspanning kosten en voor een veel snellere ademhaling zorgen. Denk alleen aan de activiteiten die u ten minste 10 minuten per keer heeft verricht.
Als u denkt aan de **afgelopen 7 dagen**, op hoeveel van deze dagen heeft u zware lichamelijke activiteiten verricht zoals **zware** lasten tillen, spitten, aerobics of wielrennen?

- ○ Dagen per week _____
- ○ Geen zware lichamelijke activiteiten

Op de dagen dat u zwaar lichamelijk actief was, hoeveel tijd heeft u daar dan gewoonlijk aan besteed? Vul in hoeveel uren of minuten per dag u daar aan besteed.

- o Uren per dag _____
- o Minuten per dag _____
- o Weet niet / niet zeker

Denkt u aan activiteiten die matige lichamelijke inspanning kosten en die u in de afgelopen 7 dagen heeft verricht. Matig intensieve lichamelijke activiteit laat u iets sneller ademen dan normaal. Denkt u weer alleen aan activiteiten die u ten minste 10 minuten per keer heeft verricht.

Als u denkt aan de afgelopen 7 dagen, op hoeveel van deze dagen heeft u matig intensieve lichamelijke activiteit verricht, zoals het dragen van lichte lasten, fietsen in een normaal tempo of dubbeltennis? Laat wandelen hier buiten beschouwing.

- o Dagen per week _____
- o Geen matig lichamelijke activiteiten

Op de dagen dat u matig intensief lichamelijk actief was, hoeveel tijd heeft u daar dan gewoonlijk aan besteed? Vul in hoeveel uren of minuten per dag u daaraan besteed.

- o Uren per dag _____
- o Minuten per dag _____
- o Weet niet/ niet zeker

Als u denkt aan de afgelopen 7 dagen, op hoeveel dagen heeft u tenminste 10 minuten per keer gewandeld? Denk hierbij aan wandelen op het werk en thuis, wandelen om van de ene naar de andere plaats te komen, en al het andere wandelen dat u deed tijdens recreatie, sport of vrijetijdsbesteding.

- Dagen per week _____
- Geen wandelen

Op de dagen dat u ten minste 10 minuten per keer wandelde, hoeveel tijd heeft u daar dan gewoonlijk aan besteed? Vul in hoeveel uren of minuten per dag u daaraan besteed.

- Uren per dag _____
- Minuten per dag_____
- Weet niet/ niet zeker

Hoeveel tijd bracht u gewoonlijk zittend door gedurende een doordeweekse dag in de afgelopen 7 dagen? Bij deze tijd mag zitten achter een bureau, tijd die zittend wordt doorgebracht met vrienden, zittend lezen, studeren of tv kijken worden gerekend. Vul in hoeveel uren of minuten per dag u daaraan besteed.

- ▢ Uren per dag _____
- ▢ Minuten per dag _____
- ▢ Weet niet/ niet zeker

Het tweede onderdeel begint hier. U krijgt een aantal vragen waarin twee mogelijke trainingsprogramma's worden beschreven. Wij vragen u te kiezen voor het programma dat u het beste vindt. De programma's zijn opgebouwd uit een aantal kenmerken. Deze kenmerken worden hieronder beschreven.

Intensiteit: Bij de intensiteit wordt beschreven hoe vaak en hoe lang u elke week bezig bent met het programma. Dit verschilt van 1 keer in de week 60 minuten tot 6 keer in de week 20 minuten.

Soort activiteit: Bij de soort activiteit wordt beschreven hoe zwaar de inspanning is. Dit verschilt tussen licht intensief bewegen zoals wandelen en zwemmen, tot zwaar intensief bewegen zoals wielrennen en aerobics.

Verbetering van de gezondheid: Bij de verbetering van de gezondheid wordt beschreven in hoeverre u merkt dat uw uithoudingsvermogen verbeterd is. Dit verschilt van klein, waarbij nauwelijks vermindering van vermoeidheid en/of verbetering van uw uithoudingsvermogen wordt gemerkt, tot groot, waarbij iemand nauwelijks meer vermoeid is en naast de dagelijkse werkzaamheden ook nieuwe activiteiten kan oppakken.

Soort begeleiding: Bij de soort begeleiding wordt beschreven in welke mate het trainingsprogramma aan de persoonlijke situatie is aangepast. Dit verschilt tussen niet aan uw persoonlijke situatie aangepast, waarbij er ook geen metingen uitgevoerd hoeven te worden, tot volledige aanpassing aan de persoonlijke situatie, waarbij veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd.

Inzet van de app: Bij de inzet van de app wordt beschreven hoe vaak de app berichten verzendt. Dit verschilt tussen wekelijks, waarbij slechts één keer in de week berichten worden verzonden, tot dagelijks, waarbij er meerdere keren per dag berichten worden verzonden.

Inzet van persoonlijke begeleiding: Bij de inzet van persoonlijke begeleiding wordt gevraagd hoe jouw perfecte coach moment eruitziet. Dit verschilt tussen alleen via de app contact met een coach, tot het alleen bezoeken van een coaching praktijk.

Nadat u uw optie heeft doorgegeven wordt gevraagd of u het door u gekozen trainingsprogramma ook echt gaat volgen.

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 1 keer per week 45 tot 60 minuten achter elkaar	U sport 5 keer per week 20 tot 30 minuten achter elkaar
Soort activiteit	**Licht intensief:** Wandelen of Zwemmen	**Zwaar intensief:** Hardlopen, Aerobics of Wielrennen
Verbetering van de gezondheid	**Klein:** Na 4 weken deelname aan het programma merkt u nauwelijks vermindering van uw vermoeidheid en/of verbetering van uw uithoudingsvermogen	**Groot:** Na 4 weken deelname aan het programma bent u nauwelijks meer vermoeid en kunt u, naast uw dagelijkse werkzaamheden, ook nieuwe activiteiten oppakken.
Soort begeleiding	Het trainingsprogramma wordt **niet** aan uw persoonlijke situatie aangepast, er hoeven geen metingen worden uitgevoerd	Het trainingsprogramma wordt **volledig** aan uw persoonlijke situatie aangepast, er moeten veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd
Inzet van de app	U ontvangt **wekelijks** een bericht op uw telefoon	U ontvangt **dagelijks meerdere** berichten op uw telefoon
Inzet van persoonlijke begeleiding	U heeft alleen contact via de app	U bezoekt zowel een coachingspraktijk en u heeft contact via de app

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- ○ Ja
- ○ Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 1 keer per week 45 tot 60 minuten achter elkaar.	U sport 3 keer per week 30 tot 45 minuten achter elkaar.
Soort activiteit	**Matig intensief:** Joggen, Fietsen of Balsporten	**Licht intensief:** Wandelen of Zwemmen
Verbetering van de gezondheid	**Klein:** Na 4 weken deelname aan het programma merkt u nauwelijks vermindering van uw vermoeidheid en/of verbetering van uw uithoudingsvermogen	**Groot:** Na 4 weken deelname aan het programma bent u nauwelijks meer vermoeid en kunt u, naast uw dagelijkse werkzaamheden, ook nieuwe activiteiten oppakken.
Soort begeleiding	Het trainingsprogramma wordt **volledig** aan uw persoonlijke situatie aangepast, er moeten veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd	Het trainingsprogramma wordt **niet** aan uw persoonlijke situatie aangepast, er hoeven geen metingen worden uitgevoerd
Inzet van de app	U ontvangt **dagelijks meerdere** berichten op uw telefoon	U ontvangt **dagelijks meerdere** berichten op uw telefoon
Inzet van persoonlijke begeleiding	U bezoekt alleen een coachingspraktijk	U bezoekt alleen een coachingspraktijk

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- Ja
- Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 1 keer per week 45 tot 60 minuten achter elkaar	U sport 5 keer per week 20 tot 30 minuten achter elkaar
Soort activiteit	**Zwaar intensief:** Hardlopen, Aerobics of Wielrennen	**Matig intensief:** Joggen, Fietsen of Balsporten
Verbetering van de gezondheid	**Matig:** Na 4 weken deelname aan het programma bent u minder vermoeid en kunt u uw dagelijkse werkzaamheden langer, en makkelijker volhouden.	**Matig:** Na 4 weken deelname aan het programma bent u minder vermoeid en kunt u uw dagelijkse werkzaamheden langer, en makkelijker volhouden.
Soort begeleiding	Het trainingsprogramma wordt **volledig** aan uw persoonlijke situatie aangepast, er moeten veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd	Het trainingsprogramma wordt **niet** aan uw persoonlijke situatie aangepast, er hoeven geen metingen worden uitgevoerd
Inzet van de app	U ontvangt **dagelijks** een bericht op uw telefoon	U ontvangt **dagelijks meerdere** berichten op uw telefoon
Inzet van persoonlijke begeleiding	U heeft alleen contact via de app	U heeft alleen contact via de app

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- ○ Ja
- ○ Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 3 keer per week 30 tot 45 minuten achter elkaar	U sport 1 keer per week 45 tot 60 minuten achter elkaar
Soort activiteit	**Licht intensief:** Wandelen of Zwemmen	**Matig intensief:** Joggen, Fietsen of Balsporten
Verbetering van de gezondheid	**Klein:** Na 4 weken deelname aan het programma merkt u nauwelijks vermindering van uw vermoeidheid en/of verbetering van uw uithoudingsvermogen.	**Groot:** Na 4 weken deelname aan het programma bent u nauwelijks meer vermoeid en kunt u, naast uw dagelijkse werkzaamheden, ook nieuwe activiteiten oppakken.
Soort begeleiding	Het trainingsprogramma wordt **volledig** aan uw persoonlijke situatie aangepast, er moeten veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd	Het trainingsprogramma wordt **niet** aan uw persoonlijke situatie aangepast, er hoeven geen metingen worden uitgevoerd
Inzet van de app	U ontvangt **dagelijks** een bericht op uw telefoon	U ontvangt **dagelijks** een bericht op uw telefoon
Inzet van persoonlijke begeleiding	U bezoekt zowel een coachingspraktijk en u heeft contact via de app	U bezoekt zowel een coachingspraktijk en u heeft contact via de app

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- ○ Ja
- ○ Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 5 keer per week 20 tot 30 minuten achter elkaar	U sport 3 keer per week 30 tot 45 minuten achter elkaar
Soort activiteit	**Licht intensief:** Wandelen of Zwemmen	**Matig intensief:** Joggen, Fietsen of Balsporten
Verbetering van de gezondheid	**Groot:** Na 4 weken deelname aan het programma bent u nauwelijks meer vermoeid en kunt u, naast u dagelijkse werkzaamheden, ook nieuwe activiteiten oppakken.	**Groot:** Na 4 weken deelname aan het programma bent u nauwelijks meer vermoeid en kunt u, naast u dagelijkse werkzaamheden, ook nieuwe activiteiten oppakken.
Soort begeleiding	Het trainingsprogramma wordt **deels** aan uw persoonlijke situatie aangepast, er moeten enkele metingen (lichaamsgewicht, hartslag in rust) worden uitgevoerd	Het trainingsprogramma wordt **volledig** aan uw persoonlijke situatie aangepast, er moeten veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd
Inzet van de app	U ontvangt **dagelijks** een bericht op uw telefoon	U ontvangt **wekelijks** een bericht op uw telefoon
Inzet van persoonlijke begeleiding	U heeft alleen contact via de app	U heeft alleen contact via de app

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- Ja
- Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 3 keer per week 30 tot 45 minuten achter elkaar	U sport 3 keer per week 30 tot 45 minuten achter elkaar
Soort activiteit	**Zwaar intensief:** Hardlopen, Aerobics of Wielrennen	**Zwaar intensief:** Hardlopen, Aerobics of Wielrennen
Verbetering van de gezondheid	**Klein:** Na 4 weken deelname aan het programma merkt u nauwelijks vermindering van uw vermoeidheid en/of verbetering van uw uithoudingsvermogen.	**Matig:** Na 4 weken deelname aan het programma bent u minder vermoeid en kunt u uw dagelijkse werkzaamheden langer, en makkelijker volhouden.
Soort begeleiding	Het trainingsprogramma wordt **deels** aan uw persoonlijke situatie aangepast, er moeten enkele metingen (lichaamsgewicht, hartslag in rust) worden uitgevoerd	Het trainingsprogramma wordt **niet** aan uw persoonlijke situatie aangepast, er hoeven geen metingen worden uitgevoerd
Inzet van de app	U ontvangt **dagelijks meerdere** berichten op uw telefoon	U ontvangt **wekelijks** een bericht op uw telefoon
Inzet van persoonlijke begeleiding	U heeft alleen contact via de app	U bezoekt zowel een coachingspraktijk en u heeft contact via de app

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- ○ Ja
- ○ Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 5 keer per week 20 tot 30 minuten achter elkaar	U sport 3 keer per week 30 tot 45 minuten achter elkaar
Soort activiteit	**Licht intensief:** Wandelen of Zwemmen	**Matig intensief:** Joggen, Fietsen of Balsporten
Verbetering van de gezondheid	**Matig:** Na 4 weken deelname aan het programma bent u minder vermoeid en kunt u uw dagelijkse werkzaamheden langer, en makkelijker volhouden.	**Matig:** Na 4 weken deelname aan het programma bent u minder vermoeid en kunt u uw dagelijkse werkzaamheden langer, en makkelijker volhouden.
Soort begeleiding	Het trainingsprogramma wordt **volledig** aan uw persoonlijke situatie aangepast, er moeten veel metingen (motivatie, bloeddruk, hartslag bij inspanning, cholesterol) worden uitgevoerd	Het trainingsprogramma wordt **deels** aan uw persoonlijke situatie aangepast, er moeten enkele metingen (lichaamsgewicht, hartslag in rust) worden uitgevoerd
Inzet van de app	U ontvangt **wekelijks** een bericht op uw telefoon	U ontvangt **dagelijks** een bericht op uw telefoon
Inzet van persoonlijke begeleiding	U bezoekt alleen een coachingspraktijk	U bezoekt alleen een coachingspraktijk

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- ○ Ja
- ○ Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 5 keer per week 20 tot 30 minuten achter elkaar	U sport 1 keer per week 45 tot 60 minuten achter elkaar
Soort activiteit	**Matig intensief:** Joggen, Fietsen of Balsporten	**Zwaar intensief:** Hardlopen, Aerobics of Wielrennen
Verbetering van de gezondheid	**Klein:** Na 4 weken deelname aan het programma merkt u nauwelijks vermindering van uw vermoeidheid en/of verbetering van uw uithoudingsvermogen.	**Groot:** Na 4 weken deelname aan het programma bent u nauwelijks meer vermoeid en kunt u, naast u dagelijkse werkzaamheden, ook nieuwe activiteiten oppakken.
Soort begeleiding	Het trainingsprogramma wordt **deels** aan uw persoonlijke situatie aangepast, er moeten enkele metingen (lichaamsgewicht, hartslag in rust) worden uitgevoerd	Het trainingsprogramma wordt **deels** aan uw persoonlijke situatie aangepast, er moeten enkele metingen (lichaamsgewicht, hartslag in rust) worden uitgevoerd
Inzet van de app	U ontvangt **wekelijks** een bericht op uw telefoon	U ontvangt **wekelijks** een bericht op uw telefoon
Inzet van persoonlijke begeleiding	U bezoekt zowel een coachingspraktijk en u heeft contact via de app	U bezoekt alleen een coachingspraktijk

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- ○ Ja
- ○ Nee

Wij willen graag weten wat mensen willen als ze kiezen voor een persoonlijk trainingsprogramma. Als dit u opties zouden zijn, welke zou u dan kiezen?

	Optie 1	Optie 2
Intensiteit	U sport 5 keer per week 20 tot 30 minuten achter elkaar	U sport 1 keer per week 45 tot 60 minuten achter elkaar
Soort activiteit	**Zwaar intensief:** Hardlopen, Aerobics of Wielrennen	**Licht intensief:** Wandelen of Zwemmen
Verbetering van de gezondheid	**Klein:** Na 4 weken deelname aan het programma merkt u nauwelijks vermindering van uw vermoeidheid en/of verbetering van uw uithoudingsvermogen.	**Matig:** Na 4 weken deelname aan het programma bent u minder vermoeid en kunt u uw dagelijkse werkzaamheden langer, en makkelijker volhouden.
Soort begeleiding	Het trainingsprogramma wordt **niet** aan uw persoonlijke situatie aangepast, er hoeven geen metingen worden uitgevoerd	Het trainingsprogramma wordt **deels** aan uw persoonlijke situatie aangepast, er moeten enkele metingen (lichaamsgewicht, hartslag in rust) worden uitgevoerd
Inzet van de app	U ontvangt **dagelijks** een bericht op uw telefoon	U ontvangt **dagelijks meerdere** berichten op uw telefoon
Inzet van persoonlijke begeleiding	U bezoekt alleen een coachingspraktijk	U bezoekt zowel een coachingspraktijk en u heeft contact via de app

Welke optie zou u kiezen?

Optie 1 ○ Optie 2 ○

Zou u het door u gekozen trainingsprogramma ook gaan volgen?

- ○ Ja
- ○ Nee

Appendix E – Syntax R data analysis

```
library(readxl)
results_dce_deel_2_ <- read_excel("~/Library/Mobile
Documents/com~apple~CloudDocs/results dce deel 2 .xlsx")
View(results_dce_deel_2_)

#install packages
install.packages("tidyverse")
install.packages("dplyr")
install.packages("mlogit")
install.packages("dfidx")
library(dfidx)
library(mlogit)
library(dplyr)
library(foreign)
library(tidyverse)
library(readxl)
library(survival)
library(nnet)

#mutate categorical variables into factors
results_dce_deel_2_ <- mutate(results_dce_deel_2_,
                              a = factor(a),
                              b = factor(b),
                              c = factor(c),
                              d = factor(d),
                              e = factor(e),
                              f = factor(f))

#dummy code choice "1" and "
ChoiceDummy <- ifelse(results_dce_deel_2_$choice == "true", 1, 0)
View(results_dce_deel_2_)

#Multinomial logit analysis
fit_dce<- multinom(ChoiceDummy~a+b+c+d+e+f, data=results_dce_deel_2_)
summary(fit_dce)
z <- summary(fit_dce)$coefficients/summary(fit_dce)$standard.errors
z
p <- (1 - pnorm(abs(z), 0, 1)) * 2
p
```

```
#multinomial logit analysis clusters
Cluster_1_analyse <- mutate(Cluster_1_analyse,
                        a = factor(a),
                        b = factor(b),
                        c = factor(c),
                        d = factor(d),
                        e = factor(e),
                        f = factor(f))
cluster_2_analyse_ <- mutate(cluster_2_analyse_,
                       a = factor(a),
                       b = factor(b),
                       c = factor(c),
                       d = factor(d),
                       e = factor(e),
                       f = factor(f))
View(cluster_2_analyse_)

ChoiceDummy <- ifelse(Cluster_1_analyse$choice == "true", 1, 0)
View(Cluster_1_analyse)
ChoiceDummy <- ifelse(cluster_2_analyse_$choice == "true", 1, 0)
View(cluster_2_analyse_)

fit_cluster1<- multinom(ChoiceDummy~a+b+c+d+e+f,
data=Cluster_1_analyse)
summary(fit_cluster1)
fit_cluster2<- multinom(ChoiceDummy~a+b+c+d+e+f,
data=cluster_2_analyse_)
summary(fit_cluster2)
```